AD-A189 775 BIOLOGICAL AND PHYSICAL MECHANISMS CONTROLLING THE FINE-SCALE EPIZOOPLANK..(U) ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE MIAMI FL.. P B ORTNER ET AL. 1/1

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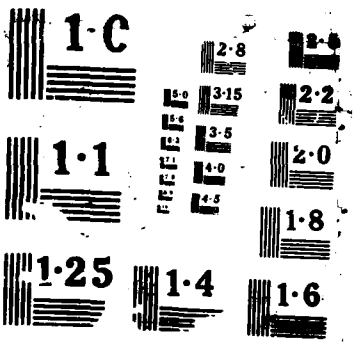
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UNIVERSITY OF Miami

Ref: 673-025-JMN:mg 10 November 1987

Dr. Bernard Zahuranec
Oceanic Biology Program
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

Dear Bernie:

This letter represents our Final Report for the contract N0O014-85-0020 (Biological and Physical Mechanisms Controlling the Fine-Scale Epizooplankton Distributions) which ended September 1987, after two, six-month, no-cost extensions. During these three years our research group fulfilled most of our short-term goals and made significant progress towards our long-range goals as outlined in previous reports. Below is a synopsis of our accomplishments during this period; the details are contained in our past progress reports.

Major Themes

We have made and continue to make significant progress towards our goal to provide biological oceanographers with the ability of obtaining fine-scale zooplankton distributional data and physical (environmental) samples on the same or similar time and space scales. The In Situ Plankton Camera and its complementary electronics package has proven to be a rugged and reliable tool to determine the fine-scale distribution of macrozooplankton relative to their physical environment. On a recent cruise in the Southern California Bight, we obtained synoptic biological and physical data on 42 of 43 Plankton Camera tows.

We have demonstrated the utility of the Acoustic Doppler Current Profiler (ADCP) to interpreting the distribution of planktonic organisms. All biological samplers towed behind or lowered over the side of a ship are blind (or near-sighted) to the surrounding physical environment. The ADCP is essential if we intend to place our biological samples and the near-field physical data obtained by underwater sensors in the context of the physical regime of the surrounding waters. Our progress in this area, although substantial, has been hampered by software changes supplied by the manufactuer. This has forced us to write separate data retrieval programs for each of our three cruises where we used this invaluable tool. We hope in the near future to share with the rest of the field our convincing results. We also hope to capitalize on the advances made by other ONR contractees (Smith and Flagg) to use this instrument to collect biological as well as physical data.

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Field Work

During the contract we were engaged in two major collaborative field programs with other ONR contractees (D.V. Holliday and R. Pieper). Both were successful. In 1985 we studied the vertical and diel variability of the fine-scale distribution of zooplankton in the Gulf Stream. Our results have been presented in 3 separate AGU/ASLO presentations and are described in two manuscripts. One of those manuscripts is dedicated to an explicit comparison between the biological patterns discerned by three independent means -- acoustics, in situ photography, and the MOCNESS. The manuscripts will be completed and available for distribution before next summer.

The emphasis of our 1987 Southern California Bight cruise was the horizontal and diel variability of the fine-scale distribution of zooplankton. As stated above, we successfully collected data on 42 or 43 tows; we expect this data set to be rich in substance and detail. The ADCP was used successfully on both cruises and will be an integral part of the interpretation of our results.

New Technology

During our contract, we entered into negotiations with D.V. Holliday and C. Greenlaw of Tracor, Inc. for the design and construction of a single, high-frequency (approx. 1 MHz) acoustic zooplankton sensor. Assuming timely funding, this sensor (the Searchlight SONAR), will be delivered to us in the present fiscal year. It has been expressly designed to be interfaced with our present electronics package. Thus it will provide us with real-time estimates of the biovolume and number of scatters preceding the mouths of either our In Situ Plankton Camera or the MOCNESS. It can be used to assess sampler avoidance and as a "searchlight" to identify regions of the water column for more intensive biological sampling where it is desirable to know the identity of the scatterers. We see this as a first step in moving towards the next generation of zooplankton samplers, "Smart Samplers." These would utilize real-time feedback from acoustic or optical sensors that could provide course, but continuous information to determine optimal sampling strategy and resource allocation of more information-rich, species-sensitive sensors.

We have made significant progress on our efforts to apply new technologies to speed the process of sample analysis (both preserved and photographic). At present we are using a digitizing system to enumerate the number of organisms, record a set of morphometric parameters and generate biomass estimates and size frequency spectra from biological (preserved) samples. With a few, small changes this system could also be used for silhouette photographs.

Program Development

Negotiations were initiated (and still continue) to conduct a joint oceanographic ship-of-opportunity program with Pakistan to study the Arabian Sea. Our interest in the Arabian Sea is centered around the large biological response that results from water column, wind-driven mixing during the monsoonal season. To this end, P. Ortner travelled to Karachi, Pakistan to attend the 1986

International Conference on Marine Science of the Arabian Sea and delivered a paper, "Applications of simple photographic techniques to zooplankton sampling and sample processing." In addition, Dr. S. Quraishee, Director of the National Institute of Oceanography, Pakistan, was our guest in Miami for further discussions.

Towards the end of the contract P. Ortner and other ONR contractees (G. Hitchcock, D. Olson, T. Rossby, and C.S. Yentsch) proposed a collaborative study of Gulf Stream Meanders. This project proposes sampling coincident with a large physical oceanography program (SYNOP: Synoptic Ocean Prediction). A preliminary meeting was held in the Spring of 1987, in Miami, and a full-scale workshop was conveened in the Fall of the same year which we both attended. A planning/proposal document for ONR resulted from that meeting.

Conclusion

We have accomplished most of our short-term goals and have made significant progress on many of our long-term goals during the contract year. We believe that our work developing new technologies for sampling the fine-scale distribution of zooplankton has been well rewarded. We now have tools which are reliable in all but the most extreme environments. The data collected appear to be rich in substance and detail and should provide further insight into how biological and physical mechanisms control the fine-scale distribution of macrozooplankton.

Sincerely,

Peter B. Ortner
Adjunct Associate Professor
Division of Biology
and Living Resources

Jeffrey M. Napp
Postdoctoral Research Associate
Division of Biology
and Living Resources

Attachment:

Reports, Manuscripts and Publications

Ortner, P.B., M.R. Reeve, R.E. Pieper, and D.V. Holliday. 1985. Gulf Stream zooplankton study: Integration of alternative sampling strategies. **EOS** 66: 1271.

Nieman, D.R. 1986. Spatial distributions of Gulf Stream zooplankton relative to acoustic Doppler current profiles. **EOS** 67:1029.

Ortner, P.B. 1986. Applications of simple photographic techniques to zooplankton sampling and sample processing. International Conference on Marine Science of the Arabian Sea, March 29-April 2, 1986. Karachi, Pakistan.

Ortner, P.B., M.R. Reeve, and D.V. Holliday. 1986. Diel variability in Gulf Stream epizooplankton. **EOS** 67: 1029.

Anon. 1987. BIOSYNOP: A workshop report to (the) Office of Naval Research. Bigelow Laboratory for Ocean Science, September 10-13, 1987.

Ortner, P.B. 1987. Integration of a Sea-Martek fluorometer to a towed plankton camera. BIOWATT News 9: 2-3.

Ortner, P.B., M.R. Reeve, D.V. Holliday, D.R. Nieman, and J.M. Napp. 1988. Diel variation in epiplankton distributions within the Gulf Stream. To be submitted to Biol. Oceanogr.

Ortner, P.B., M.R. Reeve, R.E. Pieper, and D.V. Holliday. 1988. Perceptions of the vertical distribution of epizooplankton: Photographic, acoustic and traditional. To be submitted to J. Marine Res. or Deep-Sea Res.

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